# Bridge Preservation Scour Program

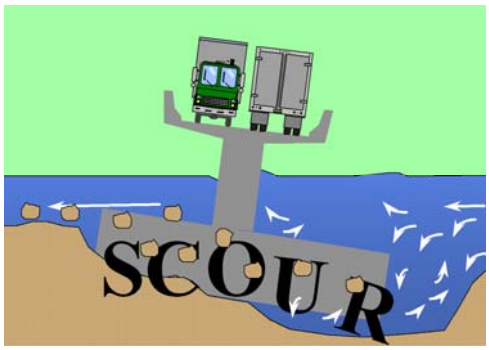
Purpose:

The purpose of this paper is to factually explain the scour mitigation program and to emphasize the criticality of scour mitigation measures allowing the department to maintain our vital transportation system.

Introduction:

Since 1923, 70 bridge failures have been documented in the state of Washington. The astounding fact is that 43 of these failures were the direct result of foundation scour due to flooding. The most recent major bridge scour event happened in 1999 on State Route 101 at the Nolan Creek Bridge.

Essential Facts:




The Wiley Dictionary of Civil Engineering and Construction defines scour as: “erosion caused by fast-flowing water containing abrasive particles or solids. Removal of sand, earth, or silt from the bottom of banks of a river.” This same dictionary defines erosion as: “progressive wearing away of land through natural actions of streams, wind, etc.”

When applying this term to bridges, we are addressing the scour or erosion of the support soils beneath a foundation support, such as a spread footing. These foundations support the bridge and, if the support soil is removed, the bridge will fail (collapse) under its own weight.

There are 300 “Scour Critical” State bridges greater than 20 feet in length and 19 “Scour Critical” state bridges less than or equal to 20 feet in length. There are 54 (out of the 300) that have been prioritized on the 2007-09 biennium P2 Program Scour Priority Array. Typically the top 6 or 7 bridges on the list are funded and repaired each year.

Bridge Scour Inspections and Reporting:

Inspection and reporting of all bridges is required on a minimum two-year cycle by federally mandated National Bridge Inventory System (NBIS) procedures. In addition to these mandatory inspections, all bridges crossing waterways are required to have a scour evaluation. This evaluation is done to identify the susceptibility of erosion of the streambed material and the degree of foundation element stability. This evaluation includes as-built foundation details, current condition of the foundation, streambed cross section profile, and stream flow rates. These scour evaluations are site specific and additional information may be required to execute an accurate analysis. There are more than 1500 WSDOT maintained bridges crossing a water

body. And, as previously stated, 300 of these bridges are considered "Scour Critical." The NBIS states that a bridge is considered to be "Scour Critical" when one or more of the following Code designations is satisfied:

Code 0: Bridge has failed and is closed to traffic, or
Code 1: The field review indicates that failure of a pier(s) or abutment(s) is imminent. The bridge is closed to traffic.
Code 2: The field review indicates that extensive scour has occurred at the bridge foundation(s). Immediate action is required to provide scour countermeasures.
Code 3: If the bridge foundation(s) is determined unstable for the calculated scour depth (three figures showing bottom of footings in relation to stream elevations).

Old vs New Bridge Designs:

Most bridges listed as "Scour Critical" were designed under an AASHTO Design Code that has experienced a number of revisions and updates. Due to better understanding and more recent recognition of risk factors, foundations are now being designed and constructed with better scour resistant details. An example of a recent scour resistant foundation type is the drilled shaft. These deep foundations will mitigate future scour concerns for any intermediate piers. End piers are often founded on the approach fills that could allow a slight potential for scour problems if a stream and associated water flow experiences a diversion such as a logjam or an abnormal amount of rainfall.

Environmental Challenges and Risks:

Future scour mitigation projects face many environmental challenges since these repairs are usually located in a vibrant waterway or stream. These projects often have many environmental permitting and work access associated requirements. A proper balance must be reached between satisfying resource agency requirements and the cost to repair the scour related foundation problem. It is imperative that in satisfying resource agency requirements that we don't lose site of the risk involved for delayed action. If a scour problem is left unchecked, there could be a very high risk of bridge failure and collapse. In the past, bridge failure due to scour has caused personal injury and even death. These unfortunate accidents also create economic loss due to traffic delays and costs associated to the routing of both commercial and private vehicles around the failure.

Conclusion:

Hopefully, the conclusion derived by this short explanation of WSDOT's Scour Mitigation Program is the realization of the vital importance of this program. The scour mitigation recommendations developed by the department are based on proven engineering procedures and calculations, sound engineering judgment, and Federal mitigation definitions. If these bridge scour critical problems are not adequately mitigated, there is a real and present risk that an identified scour critical bridge could experience failure and collapse.